FOSSIL VERTEBRATES FROM NEW GUINEA.

It is but rarely that we have opportunities of studying vertebrate fossils from New Guinea. It was therefore with eager acceptance that relics of the kind were received from the late Government Geologist, Mr. W. H. Rands, F.G.S., who had himself received them from Captain Barton, then Private Secretary to his Excellency the Lieutenant-Governor of British New Guinea. These fossils, which may possibly enable one to contribute a little to the slowly accumulating palæontology of the Possession, are from Busai in Murua, an island otherwise known as Woodlark Island. Captain Barton, to whose acumen we owe the rescue of the fossils from destruction, informs us that Busai, a place-word not found on our maps, is the name of the southern part of the western half of the island, that nearly the whole of this western moiety is a coral covered plain densely clothed with vegetation, and that the island is on the south girt about with a fringing reef and defended by an outwork of barrier reef. The spot where the bones were exhumed he considers to be within the area of an old river bed. Immediately before his first visit to it, one of the miners who were successfully prospecting for gold in the alluvial of the tract, had in the course of his work thrown some of the fossils out of his shaft on to the mullock heap alongside. Fortunately, they were there noticed by Captain Barton, who at once appropriated them, and persuaded the miner to put aside any others he might disinter. On his return to Busai long afterwards he found that the promise had been kept, and that he was able to bring away other remains which have proved more instructive.

The living evidence given by Tree-kangaroos and Cassowaries that there was once an overland route by which beast and bird could pass between Australia and New Guinea, and the supporting testimony afforded by certain Australian fossils, have naturally begotten an expectation that sooner or later some characteristic member of the land or fresh water fauna, now extinct in Australia, would be forthcoming from the strata of the more northern island. It was therefore with a lively hope of meeting an old friend or two amongst these bones that the invitation to identify them if possible was accepted. The hope was premature. The native haunt of all the four or five animals represented by them was unmistakeably marine; the age of them in consequence not determinable by means of any instance of synchronism with the great Australian marsupials or their contemporaries, or, in the absence of stratigraphical data, definable by any term less vague than Quarternary or Tertiary. Whatever the age of this alluvium may be, and whatever the changes of level experienced by its bedrock, it is evident that at the present time it lies, as Captain Burton says, but little above high water mark. The bones were, in some instances encrusted with calcareous mud, in others the cavities were filled with sand, pebbles, and ferruginous concretions, mud and grit alike containing

debris of the molluscan genera Nassa, Tellina, Arca, Venus, and of other marine organisms. It is, however, extremely doubtful whether this alluvial deposit was the real matrix of the fossils, their uniformly gray tint is free from ferruginous stains, and their substance is densely mineralised. From whatever cause, it has apparently been found difficult to exhume them otherwise than in a shattered condition, and with the very undesirable result that connecting parts which, as recent fractures testify, were in place when the whole were disturbed by the pick, are now wanting. On fitting together all the fragments, which were amenable to the process, it became apparent that the largest piece so reconstructed was a portion of the skull of a dugong. This appears to be the first occurrence known of a Halicore proper in a truly fossil state, and it is to be hoped that its stratigraphical provenance will sooner or later be definitely ascertained, since any ray of light that can be thrown upon the history of this or any other genus of the Sirenia is of unusual interest. Meanwhile it is desirable to determine, if possible, the specific status of this particular dugong in answer to the question which at once rises, whether it is or is not an extinct form of its kind. Assuming that the dugong of the Red Sea, of the Indian Ocean and of Australian waters, are all three specifically distinct (an assumption which is extremely questionable), the writer cannot but regret that the Australian animal is the only one whose craniological characters are known to him. He would therefore decline to discuss the question raised were it not for the great improbability involved in a supposition that one of the western species, the Indian for example, might at some remote time have inhabited Australian seas also, left its bones on Papuan shores, and at last contracted its range under pressure of a new species evolved from itself or migrating from elsewhere. The thing is certainly possible, but too unlikely to invalidate the only means left of determining the question—a comparison of the fossil with the corresponding part of the skull of *Halicore australis*. The fossil figured on Plate X, consists chiefly of the angular hump formed by the deflected premaxillaries, which is so bizarre a feature in the foreskull of the dugong. The premaxillaries have been broken across in front, about half way up the muzzle, the surface of fracture displaying sections of the large enclosed tusks. Behind they have broken away at about a third of the length of their backwardly diverging processes which form the anterior margin of the narial orifice. To the left process is attached, as in the recent skull, that portion of the malar which bounds the orbit anteriorly ; also remains of the lachrymal bone above it. On the oral or inferior surface behind the premaxillaries, the maxillary, preserved as far on the left side as the alveolus of the second malar, has been reinstated and, adjacent to that point, a portion of its malar process has also been restored to its place. A portion of a malar is the only fragment remaining isolated. Unfortunately,

no molar teeth are in evidence so far, and in the absence of the forepart of the muzzle the sex cannot be positively ascertained.*

It is clear that from so small a portion of a skull an estimate of its distinctive characters, if any exist, must be founded mainly upon such peculiarities in its proportions as may be observable. Though it is pretty obvious to the eye that in general configuration it differs from the living species, the reality and extent of the difference will be more satisfactorily certified by a comparison between such measurements as the fossil affords, and corresponding measurements in a sufficient number of recent skulls. The measurements found available are the distance of the posterior end of the premaxillary suture from the lower end of the tubercle descending upon the anterior edge of the malar; the distance from the same point on the malar from a point on the aforesaid suture equidistant from the posterior end of the sutures in all the skulls compared; the distance of the end of the suture from the hinder edge of the malar process of the maxillary; the vertical depth of the rostrum measured at the end of the suture; the greatest breadth of the premaxillaries anteriorly to the end of the suture; the distance of the end of the suture from the line of maximum breadth; the least breadth of the narial process of the premaxillary. To these we may add the least depth and the least thickness of the malar. Throwing these measurements into a tabular form for more convenient reference, we have the following figures in millimetres :—

	Fossil.	Recent Skulls.									
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Distance of posterior end of premaxillary suture from lower end of malar tubercle..	113	144	135	134	133	126	138	132	151	132	125
Distance from malar tubercle to a point on suture equidistant from end of suture in all skulls	133	162	153	152	144	165	152	145	157	145	138
Distance from end of suture to hinder edge of malar process	119	144	140	138	120	128	140	134	160	131	119
Vertical depth of rostrum at end of suture ..	70	88	68	68	62	73	..	70	..	84	..
Greatest breadth of premaxillaries	100	95	85	81	80	80	85	91	100	89	72
Distance of greatest breadth from hinder end of suture	50	70	34	20	30	56	48	..	27	44	28
Least depth of malar ..	37	34	36	30	30	35	42	38	37	43	37
Least breadth of malar ..	15	20	19	18	20	21	18	21	23	21	19
Least breadth of narial process of premaxillaries	43	39	37	36	35	38	38	36	..	42	32

* From the size of the tusks as they appear in section, the animal was doubtless a male.

The general result of an inspection of these figures is that while the fossil is in certain dimensions in close accord with one or other of the recent skulls—sometimes of old males, sometimes of females—its measurements as a whole are quite different from those which obtain in *H. australis*. Perhaps the most strongly marked difference in the fossil is the comparative nearness of the fore end of the nares to the cheek bone, indicated by the first three measurements. This proximity is even greater than in No. 10, the youngest female of *H. australis* measured, while the breadth of the muzzle at its base and the strength of the circumnarial limbs of the premaxillaries, are only equalled in the oldest of living males. The physiognomy must therefore have been pronouncedly different, broader than the average *H. australis* and considerably flatter, with eyes nearer to the end of the snout. To the comparative massiveness of the skull, a feature also indicated by the data, there is, however, a rather remarkable exception apparent in the malar. The distal portion of this bone, wanting on the left side, is on the right present, but separated from the rest of the skull by the loss of its proximal portion. The tabulated measurements of the malar in recent skulls refer to its minimum depth and thickness only, and so fail to indicate its actual strength. This would not be much superior to that of the fossil, were it not that it is vastly increased by the development of a deep keel on its lower edge. Of this keel the fossil malar possesses merely a rudiment no larger that in an immature female of the present day. The conspicuous feebleness of the zygomatic arch in a skull exhibiting superior strength everywhere else may be related to the inferior leverage exerted by the less produced jaw, or possibly to less masticatory power being demanded by the sea grasses on which the creature fed. It will be seen, as well from the table of measurements as from the figure, that the premaxillaries anteriorly to the narial orifice are in the fossil broadest at the level of the nares, whereas in recent skulls their greatest breadth is across a lateral intumescence at some distance from the nares. As the intumescence is very feebly developed in the fossil, there ensues a considerable difference in the contour of the part. Viewed from above, the outline from the malar forward has an almost continuous trend towards the axis of the muzzle; in recent skulls it is so undulatory as to form a "line of beauty," the only one attributable to the animal. In all available skulls of *H. australis*, the premaxillary suture is gaping, in the fossil it is closed and suggestive of greater compactness of the facial bones. On the whole it appears to the writer that there is sufficient reason for admitting a belief that this dugong was specifically distinct from any existing species, and consequently that the genus Halicore has had in the past a history of which we have now a slight insight, and may hope to obtain more. The most appreciable feature

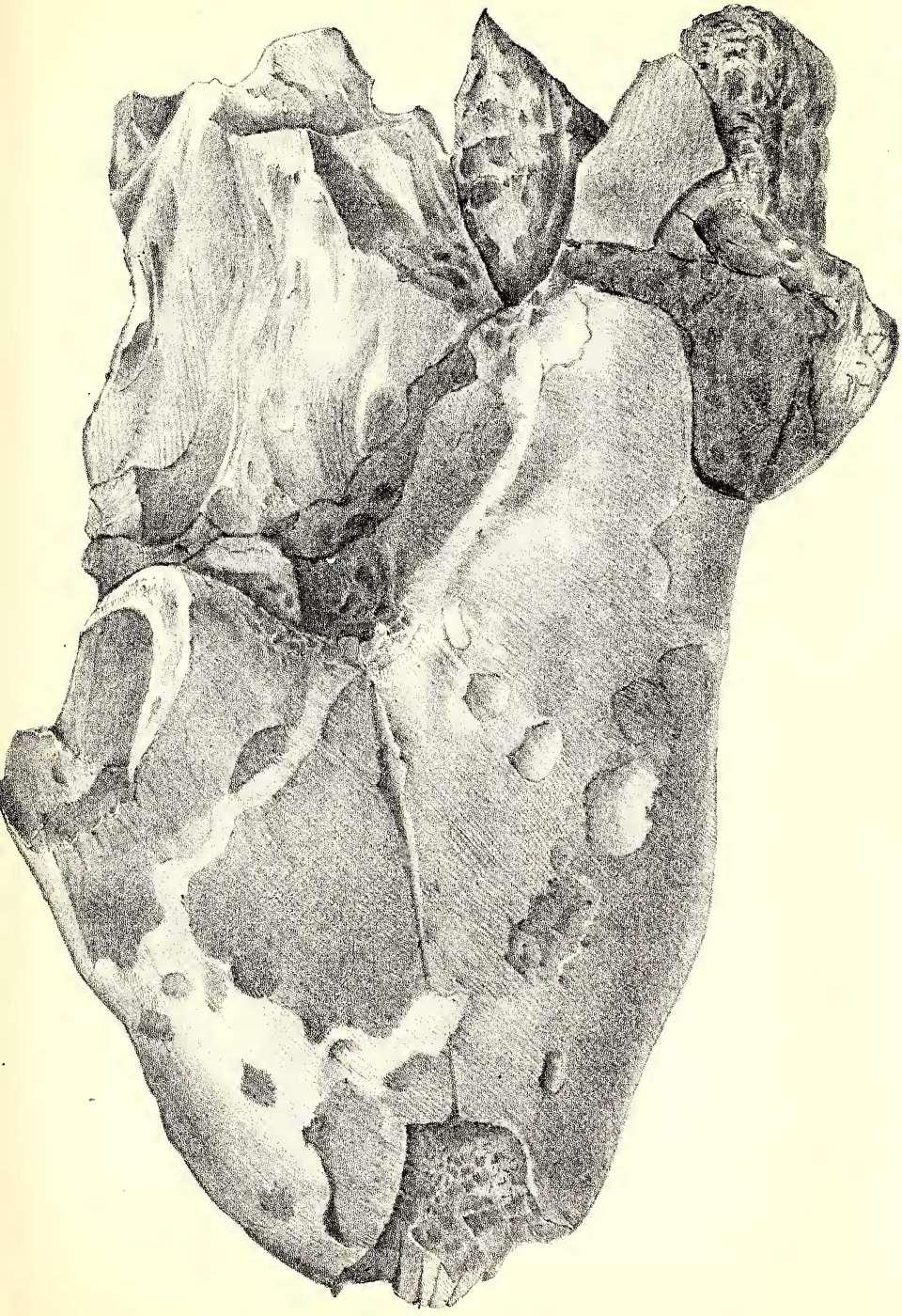
in the small fraction of the skull which has so far been revealed, the shortness of the muzzle, prompts the suggestion that it might well bear the name of Halicore brevirostris. Accompanying the skull are part of the centrum of a vertebra and the middle portion of a rib, neither of them in any way instructive.

The Reptilian remains brought to light have been left by turtles and crocodiles, the former exemplified by eight pieces of carapaces and two of interior bones, all derived from a species of rather large size. The largest portion of a carapace preserved is 180 mm. long, with a greatest breadth of 120 mm.; a marginal piece attains a thickness of 25 mm. Most of these fragments bear ribs which did not nearly reach the outer edges of the test, and therefore must have come from something other than the edible and hawksbill turtles of the present day. They appear to be all from the same species, but from at least two individuals, if we may judge from the youthful appearance of three of them. Of the endoskeletal bones, one is the anterior portion of that part of the pelvis which includes the junction of the ischial and pubic bones. It is not dissimilar to, but is of considerably larger size than the corresponding part in Chelone virgata. The other is a humerus incomplete (Plate XII), in certain parts, but affording pretty exact measurements of length and breadth, from which it appears that it was a slenderer bone than that of either of the living species, whence we may infer that the anterior " flipper " was proportionately longer. Relying on this and on the abbreviation of the ribs as distinctive characters, it is proposed to label the chelonian bones *Chelone murua*.

The Papuan crocodile of the period is partially made known to us by dorsal scutes and vertebræ, and more distinctly by portions of a mandible (Plate XI). One of the latter, a bone which reminds all who see it for the first time of a piece of the rostrum of a sawfish, is a part of a mandibular symphysis 170 mm. long and 35 mm. broad in the middle, with its edges so nearly parallel that the difference in breadth at the two ends is but 2 mm. The two rami are so intimately conjoined that not a vestige of a longitudinal suture can be found anywhere. The lower ventral surface, on which are shallow, irregular, longitudinal, branching grooves, is slightly convex transversely at the fore end, and becomes more and more so caudad. The oral surface is correspondingly, but to a less extent, concave. On each edge are eight alveoli; in five of these are remains of teeth, exhibiting, in one case, the point of a supplanting tooth. The teeth are smooth, subequal in size, subcompressed, the long diameter of their oval section placed at right angles to the longitudinal axis of the jaw. They are directed outwards and forwards at a very open angle, and the bases of their sockets are approximate to the mid line of the symphysis. Judging from the subhorizontality of the fangs, the upward curve of the crowns was but slight. The posterior

end of this bone could not have been very far from the actual end of the symphysis caudad, yet it bears no trace whatever of the entry of splenial bones, their apparent absence being probably due to the same cause as the obliteration of the symphysial suture. The second mandibular piece most probably formed a great part of the anterior moiety of the same symphysis, since in size, proportions, and structure, it resembles the posterior portion very closely. It has been split horizontally through the alveoli, of which seven only appear in the drawing of the inferior half, the base of an eighth at the anterior end being hidden from view. As the middle part of the bone and also some portion of it at each end are missing, its whole length must have been very much greater than 335 mm., and as sixteen teeth are indicated by the parts preserved, the number of the whole set must have been as great as in the Gavials. Further discovery may, indeed, shew that these mandibular remains belonged to two different individuals, a contingency hardly probable, but even then the presence of eight teeth in a portion only of a symphysis would make good a claim to membership in the family of the *Gavialidæ*. All things considered, it appears to the writer more likely that this Crocodile belonged, if to any existing genus, to the Indian *Gavialis* than to the Bornean *Tomistoma*, and to the former genus it is provisionally referred under the name *Gavialis papuensis*. The fossils under review came to hand in two lots at a long interval of time. Among the first comers were the two dorsal scutes shewn on Plate XIII., figs. 3 and 4. These appeared at the time to resemble the corresponding scutes of *Philas johnstonii* so closely, differing from them no more than similar scutes from different individuals of that species varied from each other, that they suggested a possible explanation of the mystery of the isolation of the long-nosed crocodile in the fresh waters of Northern Australia, and were figured with that view. The advent of the mandible has put an end to all speculation in that direction, all the bones evidently belong to the same species. These scutes and the mandible very possibly belonged to the same individual. Not so, however, with a third scute. This is 75 mm. in breadth, a size which makes it probable that the species grew to a length of twelve or thirteen feet. The vertebræ are three presacral, one sacral, and two caudal, doubtless derived from the same skeleton, but all very imperfect and for determinative purposes useless. It is, indeed, only from the shape and proportions of the intervertebral surfaces of their centra that their position in the vertebral column can be made out. The only ichthyan relic is a vertebra of a large shark.

Plate X



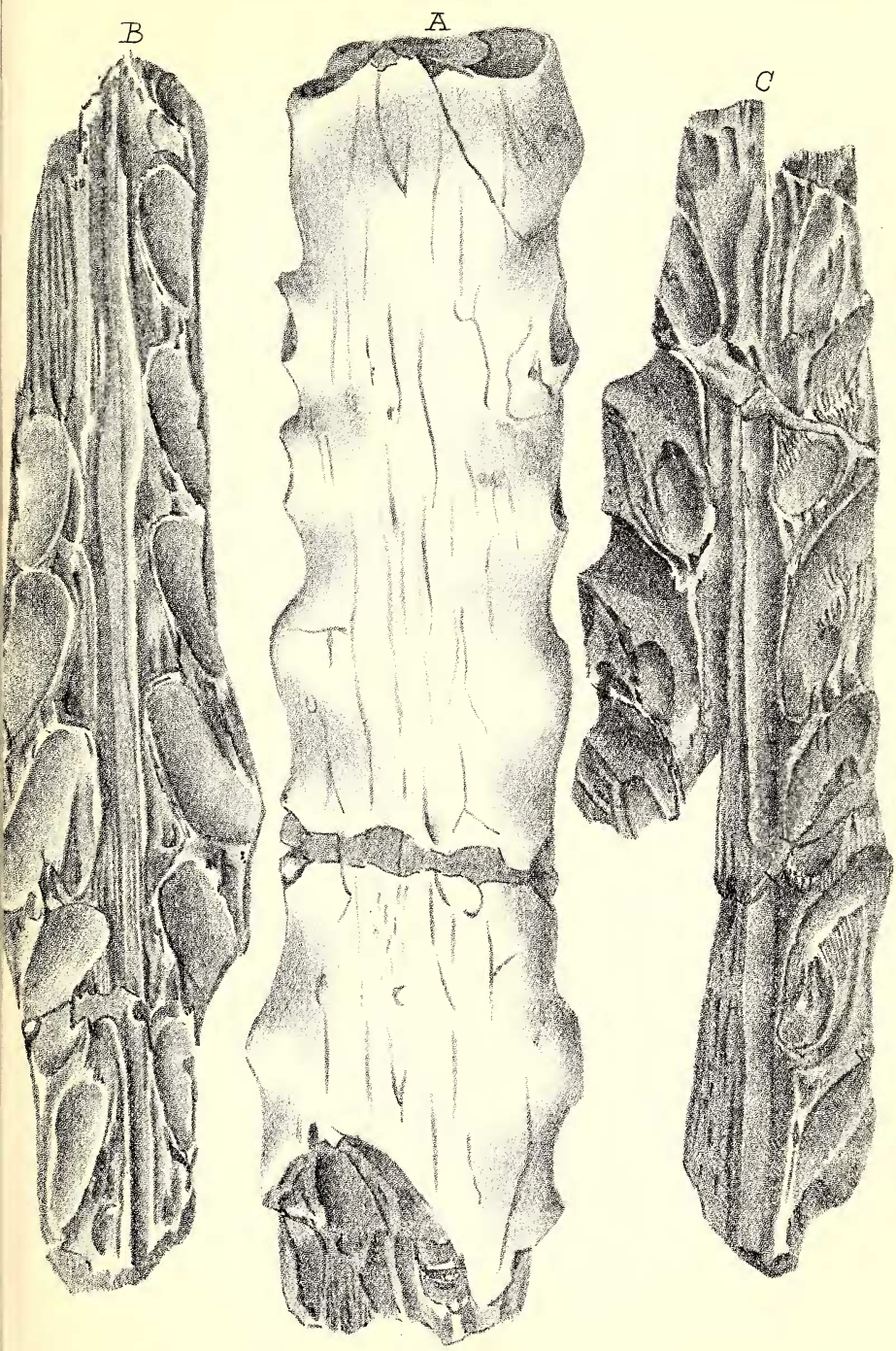

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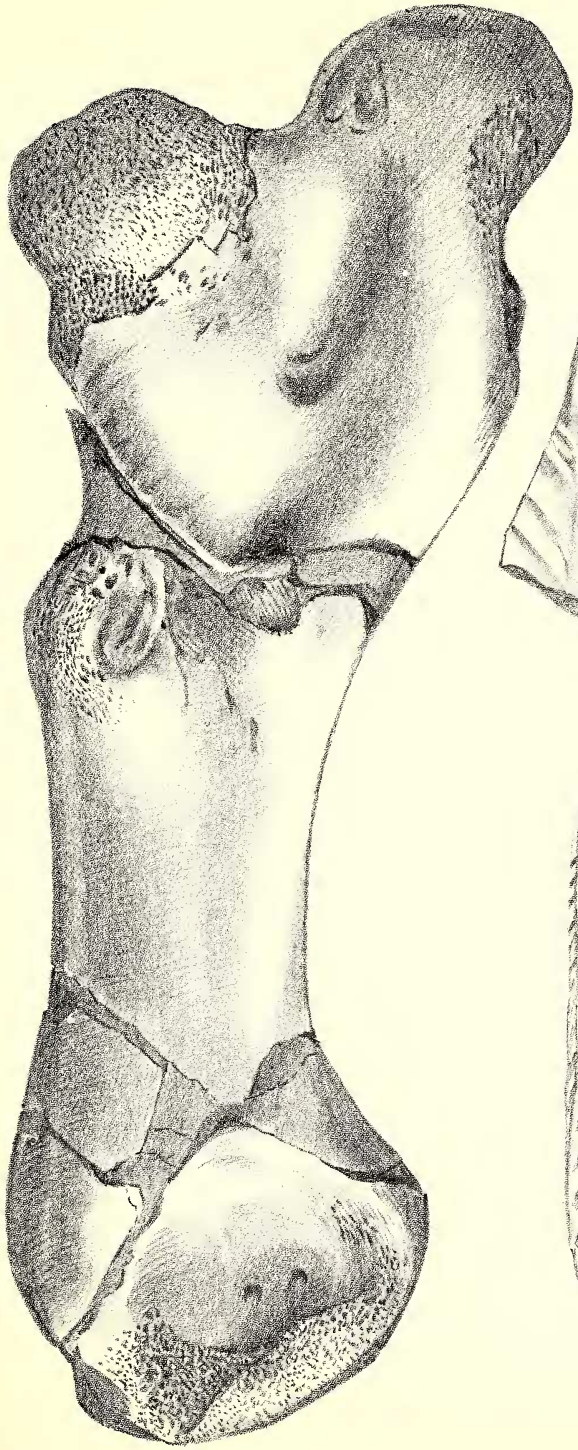
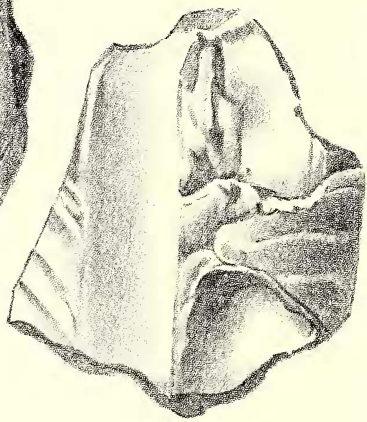
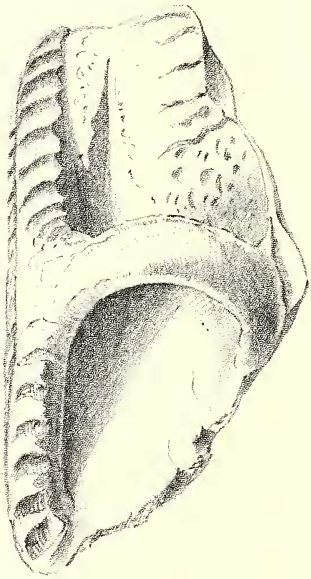
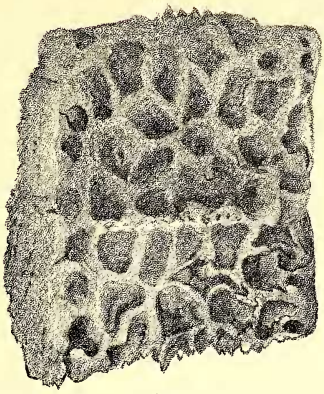
Plate XII









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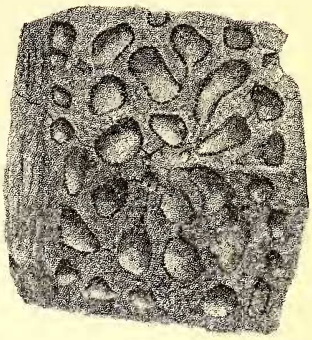

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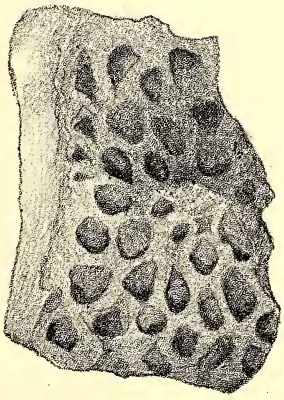

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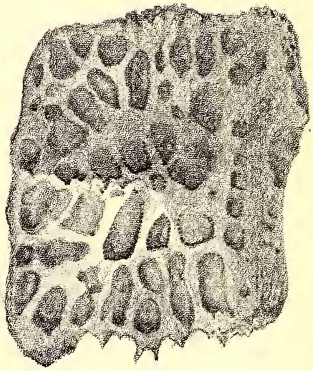

2

1.2 Crocodilus johnstoni.
3,4 " species, fossil.